Space Weather Technical Forecast

Issued on Tuesday, 19 April 2022 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares likely throughout (R1/R2 Radio Blackouts). Active Electron Fluence likely later in the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was moderate over the last 24 hours, due to two M-class flares from 2993 (Fki/Beta-Gamma), an M1.3 at 18/0748UTC and an M1.1 at 18/1027UTC along with an M1.9 at 18/1724UTC from 2992 (Dsi/Beta) which is close to the southwestern limb. The other significant region on the northeastern quadrant 2994 (Eko/Beta) has been relatively inactive with only C-class flares. There are two other smaller and benign numbered regions on the visible disc, 2990 (Cro/Beta), which is a fading region, and 2991 (Hsx/Alpha) which is relatively stable. In addition there is a small unnumbered region in the southeast quadrant and an emerging region close to the northeastern limb.

Analysis of a large filament eruption close to 2992, indicates that this is not expected to affect the Earth. No further potentially Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed has been under the influence of the high speed stream from coronal hole 75, peaking at 600km/s at 18/0234UTC, but has otherwise averaged around 550km/s. Density was steady and around average for much of the period. The total magnetic field, IMF, has been weak throughout, declining from a peak of around 8nT at 19/0125UTC to just under 5nT by the end of the period. The north-south component, Bz varied weakly. The phi angle was predominantly positive (away from the Sun) throughout. Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES-16 at GEO was at background levels throughout. The high energy electron flux (greater than 2MeV) started at background levels but has been mainly moderate or high since around 19/0600UTC, with several peaks just above the 1e3pfu threshold. The electron fluence has been below the Active threshold throughout.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be moderate over the next four days with M-class flares expected and a slight chance of X-class flaring, mainly from the regions currently in the northeast quadrant.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the forecast. Solar wind speeds of around 500-550km/s are likely on 19 April due to the high speed stream from coronal hole 75. The high s-peed stream from coronal hole 76 may then connect with the Earth on 20 or 21 April. Generally Quiet to Unsettled conditions are forecast, with a very slight chance of G1/Minor Storms on 19 April and on either 20 or 21 April.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at background levels, although there is an increasing risk as the most complex regions rotate westward. The high energy electron flux (greater than 2MeV) is likely to remain mainly moderate or high over the next four days in the absence of any significant geomagnetic activity. There is an increasing likelihood of the electron fluence exceeding the Active (1e8 integrated pfu) threshold later in the period.

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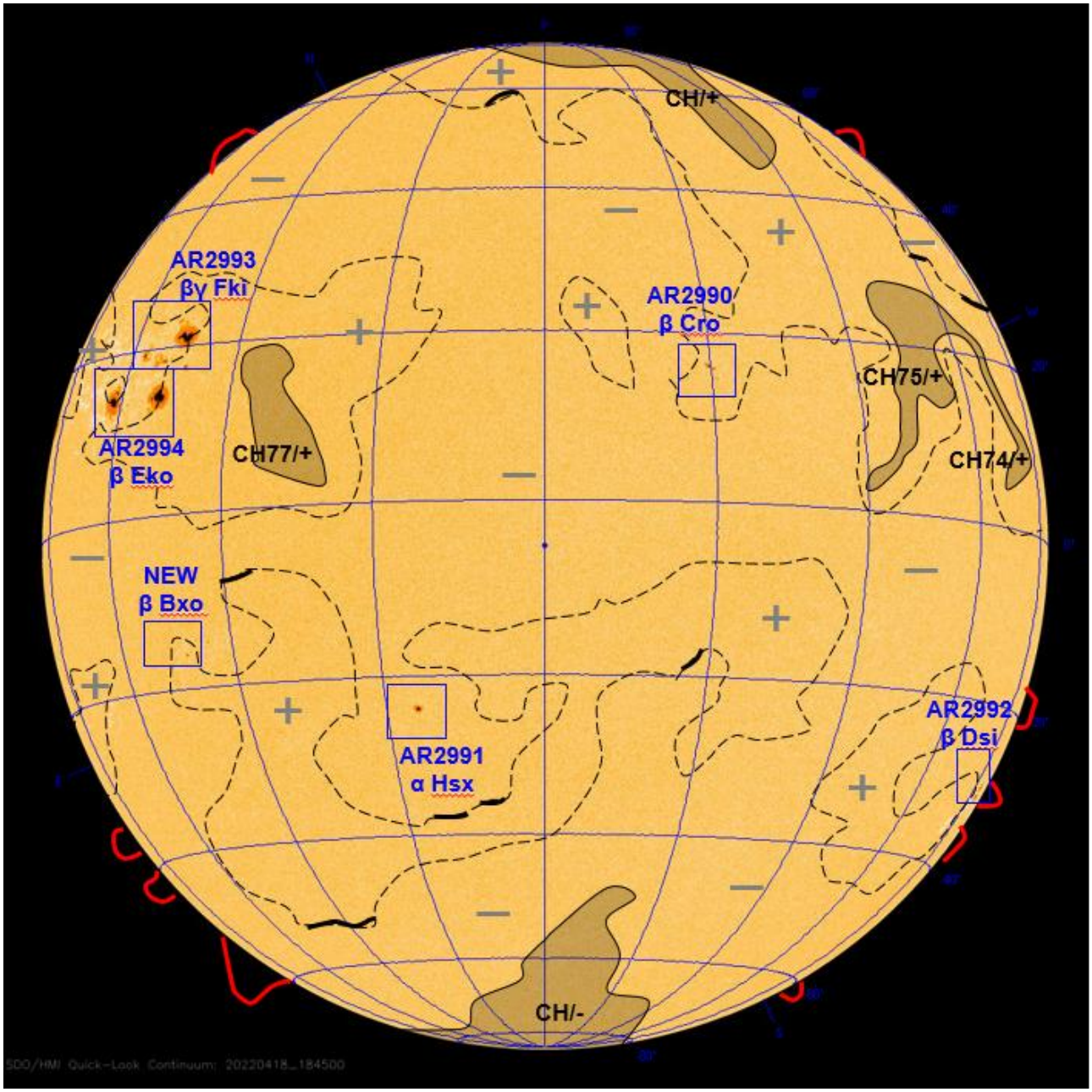
Figure 1. Solar Analysis Valid 18/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

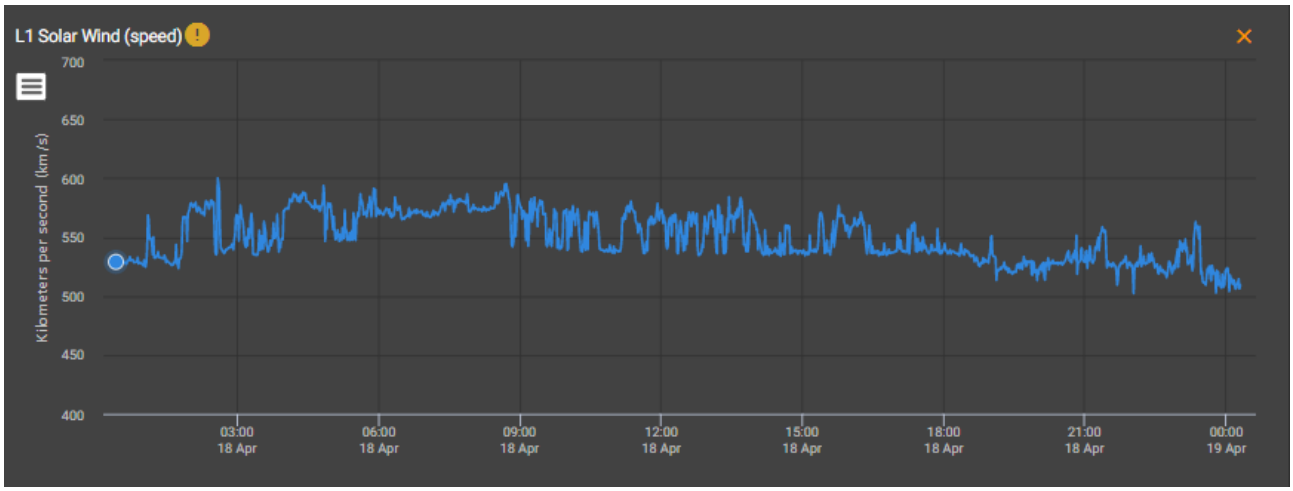
There are no CMEs expected in this forecast period, although there is a risk of minor unforecast transient features due to the number of CMEs observed over recent days.
The Earth is likely to be under the influence of the high speed stream from coronal hole 75 for the next 24-36 hours. As this is a positive hole, this feature is unlikely to significantly affect the geomagnetic activity, with only a low risk of storming. There is a suggestion in persistence of a coronal hole high speed stream connection on day 2 or 3 (210 or 21 April) with coronal hole 76. Despite this not being visible on latest imagery, there is signs of the feature on STEREO A data.
Geomagnetic activity is expected to be mainly Quiet to Unsettled, with a very slight risk of Active or G1/Minor Storm intervals due to any elevated coronal hole high speed streams on 19 April and on either 20 or 21 April.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected

Figure 2: L1 (DSCOVR) solar wind speed for the last 24 hours.



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Radio Blackouts - X-Ray Flares:
2993 (Fki/Beta-Gamma) and 2994 Eko/Beta) are the most significant regions on the visible disc, with both responsible for regular C-class and occasional M-class flaring over the last 24 hours, with configuration of both regions making more significant flaring possible. It is also possible that a third region is developing between these two regions, further adding to any complexity. 2992 (Dsi/Beta), which produced a recent M-class flare is rotating away from the Earth across the western limb. The remaining regions are small and benign, although a further region appears to be rotating onto the northeast limb and will need to be monitored.

M-class flares are expected throughout, based on the position and complexity of the two large regions in the northeast. There is also a slight chance of X-class flaring from these regions.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	80	80	80	80
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 3: SDO HMI intensitygram and magnetogram imagery of the complex region in the northeast. 2993 (Fki/Beta-Gamma) is to the top of the image with 2994 (Eko/Beta) below.

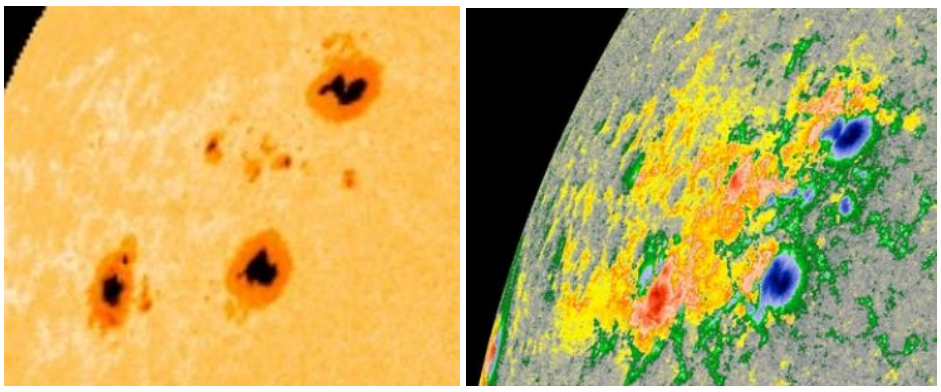

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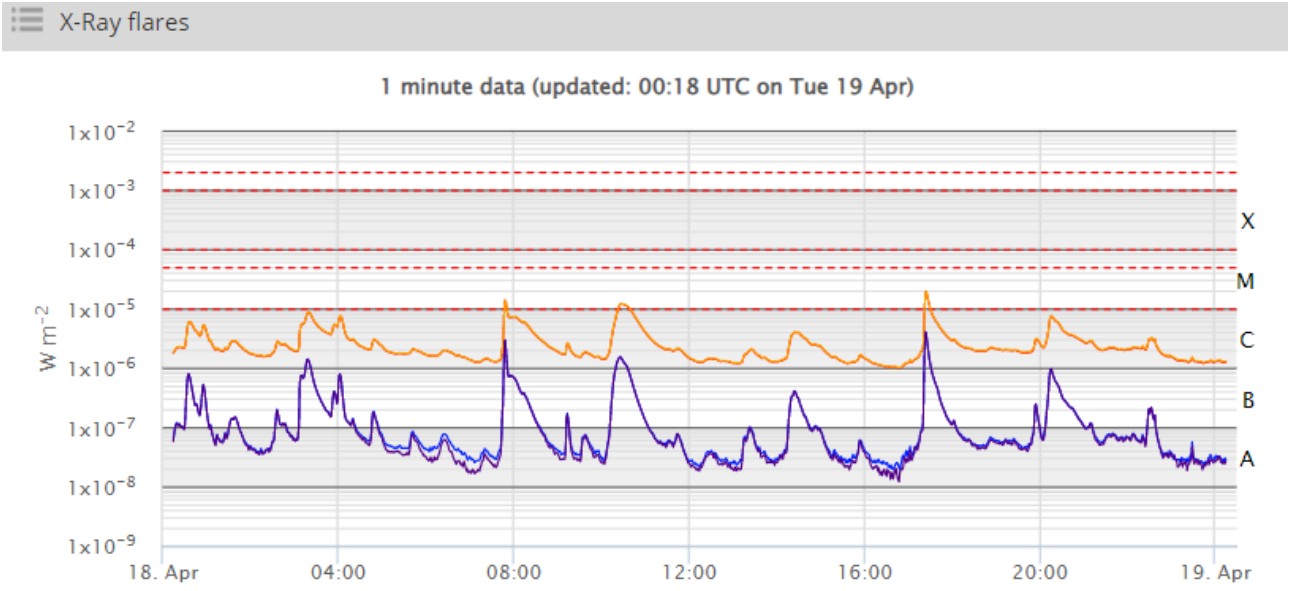
Figure 4: 24 hour GOES 16 X-ray flux



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days.

The complex regions in the northeast are a little too far east to currently affect the probabilities in this period, but will be monitored. The region in the far southwest will rotate from view over the next 24 hours and present no further risk from proton storms.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
The high energy electron flux as observed by GOES-16 at GEO has been oscillating between moderate and high levels through much of the days and is expected to continue at this level through much of the next four days, presuming an absence of significant geomagnetic activity. Electron fluence levels are likely to rise through the next four days in the presence of the high electron flux. There is an increasing likelihood of the Active threshold being breached at the period progresses.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	40	50	60	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 24 hour Electron Flux

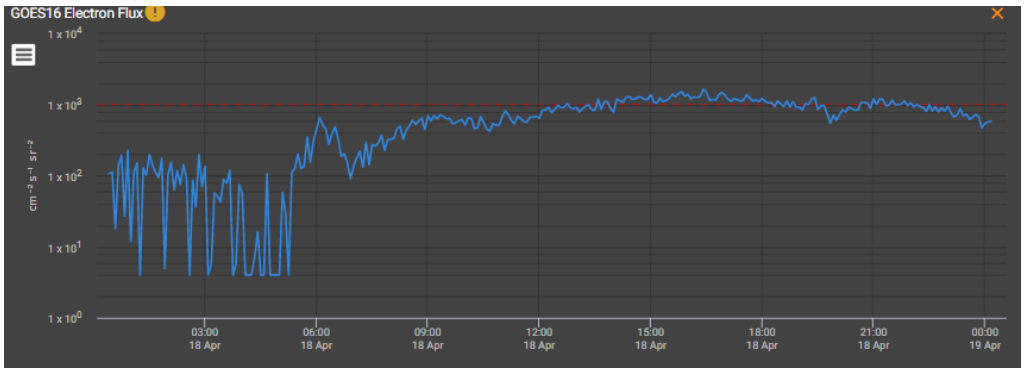
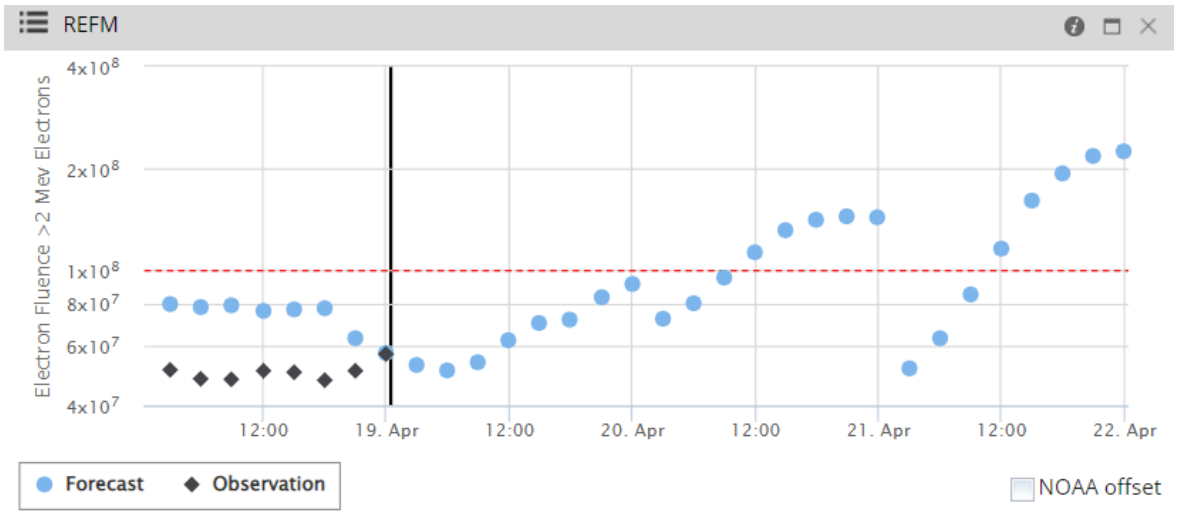


Figure 6: MOSWOC REFM (Relativistic Electron Forecast Model)



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